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ANNUAL REPORT ON THE ENVIRONMENT

**CHAPTER VII**

**NOISE, LIGHT  
POLLUTION, AND  
VISUAL POLLUTION**

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# VII-1. NOISE

## A. OVERVIEW

Addressing and solving any environmental noise problem involves two initial steps:

- Quantify the problem using noise measurements or analytical means
- Determine the applicable criteria, goals, or noise limits.

The first step, quantifying sound, is usually straightforward; the second step, finding an applicable limit, is also made simple if the community affected has in place a well-written and workable environmental noise ordinance or guideline. With "global" environmental noise sources, such as highways, railroads, and aircraft, the primary responsibility lies with federal authorities to provide the necessary regulatory guidelines. The task of establishing applicable guidelines and limits is increasingly being delegated to state authorities under the supervision of the appropriate federal agencies. The knowledge of how to measure and control environmental noise is a professional expertise that is readily available throughout the country. Most practicing acoustical consultants, architects, and engineers, and those working at universities and federally supported research centers throughout the country, agree that we are well-prepared to make the 21st century a "quiet" one. Yes, the invisible pollutant of environmental noise can be tamed.

Fairfax County, Virginia has its share of "Noise" sources as the reader shall learn in the following pages. However, Fairfax County has focused on the two largest sources of environmental noise. The Annual Report will focus its attention on aviation generated and highway generated noise, but this chapter will focus on just the aviation sources of noise in the County.

Fairfax County is served by Ronald Reagan Washington National Airport and the John Foster Dulles International Airport. Typically, more than 60,000 flights will be conducted each month at National and Dulles Airports. However, operations at Reagan National since September 11, 2001 were far below normal.<sup>1</sup>

Figure VII-1-1

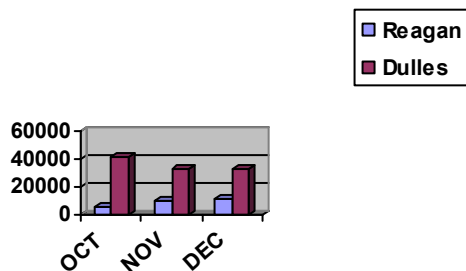


Figure VII-1-1 illustrates the traffic levels of the two airports during the months of October, November, and December of 2001. At least 90% of the flights counted for Reagan National were Air Carriers and Commuter flights while more than 85% were the same categories at Dulles.

<sup>1</sup> MWAA, "Flight Operations and Aircraft Noise Quarterly Report of Washington Dulles International Airport and Ronald Reagan Washington National Airport"; October, November, December 2001

Departing and arriving air traffic generates high levels of environmental noise within a several mile radius of each airport. Recognizing that economy of Northern Virginia has and would continue to be seriously impacted by flight reductions, the EQAC will offer a series of recommendations aimed at brokering an understanding with airport authorities that the County's residents need the capital infusion of the airports, but the aviation industry must appreciate our need for tolerable environmental noise generated by airports.

One hundred and fifty two of the 310 noise complaints processed by the Reagan National Airport Complaint Center were generated by Northern Virginia residents while 69 of 79 complaints received by the Dulles noise complaint center originated from Virginia residents. These statistics were generated from 75 and 69 Virginia callers to the Reagan National and Dulles Airports, respectively.

Reagan National has one of the strictest noise regulations in place at any major airport in the USA. All night aircraft operating between 1:00 P.M. and 7:00 A.M. must satisfy the Airport's night-time noise limits or face monetary fines of \$5,000.00 maximum per violation. In 2001, there were nine violations during the first nine months (pre 9/11). Due to heightened security, Reagan National was closed from September (post 9/11) through the end of 2001. In fact, the airport is still struggling to achieve its usual flight load to this day. During the period when Reagan National was operating, civil penalties were sought for 3 violations and 6 letters of warning were issued. Two of those cases remained open through the end of 2001, and we have no word that they have been resolved to date. The civil penalties for the one case were approximately \$4,000.00.

The Metropolitan Washington Airports Authority (MWAA) monitors aircraft and community noise around the clock at 32 locations in the metropolitan area of Washington. The monitoring equipment evaluates different sound events and separates those events likely to have been caused from aircraft from the remaining events which are attributed to the community. Based on the data provided by the MWAA, it appears that there were zero violations their statistics reveal that at least one caller to the Dulles Complaint Center made five independent complaints. From practical experience living in Sully District, the noise levels experienced vary with the weather conditions. Generally, take offs and landings of large aircraft can be heard, but those same generators produce audible noises much greater than during calm weather conditions.

The FAA uses as a baseline when determining compliant noise levels at 65 dB. Reviewing data for the final quarter indicates that DNL registered at any of the 32 monitoring sites in Virginia exceeded 65 dB by at least 3 dB on at least 11 days in October, 8 times in November, and 6 times in December. Two readings during this time period reached approximately 78 dB or roughly 13 dB above the "safe" level. The reader is cautioned to view these values in view of the fact that air traffic had been halted to a large extent during this period as fall-out from the 9/11 terrorist attack.

## **B. NOISE—WHAT IS IT?**

Environmental noise in and around buildings and communities in which people live and work has gradually and steadily increased in magnitude and diversity as civilization has advanced. The industrial growth and introduction of railroads in the 19th century accelerated the pervasiveness of environmental noise. In the 20th century, industrial growth even more dramatically exposed larger and larger segments of the population to noise, especially from the new mode of transportation-aircraft. In particular, the introduction of jet aircraft into the civil fleet in the late 1950s and early 1960s spurred the scientific- technical community, as well as the political leader-ship, to look for solutions to the growing problem of aircraft noise and environmental noise in general. In the 1975 survey, it was shown that aircraft noise is one of the leading factors in making people want to move from their neighborhoods. Approximately one-third of all the respondents who wished to move because of undesirable neighborhood conditions did so because of noise. Noise has been consistently ranked as a leading cause of neighborhood dissatisfaction. In fact, nearly one-half of the respondents each year have felt that noise was a major neighborhood problem.

From the moment of birth we are literally and figuratively immersed in a sea of sounds. We quickly learn that sound is essential for us to communicate with one another, to enjoy drama and musical performances, as well as recorded symphonies, jazz or rock music, and to appreciate countless other sounds we want to hear. Some loud sounds are necessary to warn us of oncoming potential danger, such as at a train crossing or at a construction site where a backing vehicle may be about to cross our path. One has only to be deprived of one's hearing, even temporarily, or to know someone who is severely hearing-impaired to realize how precious the gift of hearing truly is.

But some sounds around us may interfere with our ability to communicate. They may mask our enjoyment of desirable sounds; they may interfere with our ability to concentrate on a task or to learn a new one. Other sounds may startle us, interrupt our sleep, cause us psychological stress, contribute to physiological distress and, when sustained and loud enough, contribute to temporary or permanent loss of hearing. These latter sounds are "unwanted" and, by definition, are considered noise.

## **C. NOISE—WHO REGULATES IT?**

The steadily growing concern for and adoption of means to control environmental noise are everywhere evident. The fact that the noise output of the larger and more powerful jet engines necessary to serve the nation's insatiable demand for air travel has not increased with the increased mechanical power of the jet engines themselves is evidence that the nation's efforts to control noise have been productive. In fact, aircraft noise exposure in communities around airports has for the last ten years been on the decrease, as quieter aircraft become more prevalent, even though air traffic has been on the increase. The FAA's "quiet engine" research and development program began long ago, and its multitude of other aircraft and airport noise abatement research programs have led to vastly quieter

aircraft operations than would have been the case without the continuing efforts to address the thorny issues of environmental noise.

Many people think of the Occupational Safety and Health Administration (OSHA) when they think of protecting workers' health, but it can be shown that other organizations, namely the Environmental Protection Agency (EPA) and American National Standards Institute and National Institute for Occupational Safety and Health (ANSI/NIOSH), have safer standards which include a larger margin of safety.

Protecting the health of the population is and continues to be the primary motive of all public efforts to control individual and community exposure to noise. The United States has adopted the World Health Organization's (WHO) broad definition of health as not the mere absence of disease, but as the total physiological and psychological well-being of the citizenry. Congress enacted the Environmental Protection Act of 1969 and the Noise Control Act of 1972 to mandate and implement practical and achievable standards and policies to ensure that the broad public health and environmental objectives with respect to individual and community noise are met. The United States Environmental Protection Agency (EPA), which grew out of the 1969 environmental legislation, assumed responsibility for coordinating the development of noise policies, standards, and guidelines in cooperation with several major federal agencies. Chief among them are the Federal Aviation Administration (FAA) and others having cognizance over major sources or receptors of environmental noise.

## **D. QUANTIFYING SOUND: A BIT ABOUT THE NUMBERS**

MWAA employs two metrics that are used to determine the impact of aircraft noise in our area. The first is the Day-Night average sound level (DNL). This is the measure preferred by the FAA. The second metric provides the actual noise level that was exceeded for a particular percent of time of the reporting period (1 month). The following provides the reader with a basic understanding of the significance and value of the many different metric.

The full, audible frequency range for young, healthy ears extends from about 20 Hz (cycles per second) to about 20,000 Hz. However, the human hearing mechanism is most sensitive to sounds in the 500- to 8,000-Hz range. Above and below this range, the ear is inherently less sensitive. With increasing age, the ear becomes progressively less sensitive to sound over the entire frequency range (presbycusis). Persons who are exposed to loud noise over a long period of time can also incur a hearing loss that usually most significantly affects hearing acuity in the mid- and high-frequency ranges. To account for the varying sensitivity of the normal human ear to sound over the audible frequency range, sound level meters incorporate an electronic filter (or weighting network) that approximates the way the human ear perceives sound over the audible frequency range. Sound level values obtained using this weighting network are referred to as "A-weighted" sound levels and are signified by the identifying unit, dBA. To give some perspective to this simple sound level descriptor, Figure 1 shows A-weighted levels over the full dynamic range of human hearing, from very

quiet concert halls and recording studios at about 20 dBA, up to levels of 130 dBA that would cause pain and potential hearing damage, even for short time exposures.

Both indoor and outdoor environmental sound levels usually vary markedly with time, whether in a relatively quiet setting such as in a remote rural area or in highly developed downtown urban community. With such time-varying sound, as with the weather, there is no simple convenient metric to completely describe the quality and quantity of sound energy present.

## **E. NOISE SUPPRESSION/ABATEMENT GUIDANCE**

### **1. Federal Aviation Administration**

The FAA does not specify aircraft noise exposure limits for communities near airports. Instead, the FAA sets limits on noise emissions from individual types of aircraft and sets deadlines for permitted operation of aircraft at U.S. airports that do not conform to these limits. Aircraft noise emission limits are important to communities around airports, but they are also important to airport planners who need to evaluate the noise impact of changes in airport operations produced by changes in facilities and normal growth in air traffic. Most airports, even smaller general aviation airports, maintain an airport master plan. An airport master plan is a written document that outlines all aircraft operations, assesses environmental effects including noise, and forecasts future airport growth.

Airport noise exposure information is normally presented as yearly day-night average sound level contours overlain on a map of the area.  $L_{dn}$  contours are normally presented in 5 dB increments beginning with the 65 dB contour. Some major airports have  $L_{dn}$  contours as high as 80 dB close to the ends of major departing runways. These maps are used by architects and engineers to interpolate aircraft day-night average sound levels at their project sites in the vicinity of airports. This information is used to evaluate the need for special sound isolation wall and window constructions to protect interior spaces of the building from excessive aircraft noise (Table VII-1-1).

## **F. THE POTOMAC CONSOLIDATED TRACON AIRSPACE REDESIGN ENVIRONMENTAL IMPACT STATEMENT (EIS)**

In our 2001 *Annual Report*, EQAC briefly discussed the EIS project. In January 2002, the US Department of Transportation, Federal Aviation Administration, published a two volume report of the Draft EIS. For purposes of our 2002 Annual Report, we have extracted conclusions and recommendations from the report's "Executive Summary" dated January 2002. The Draft EIS is under peer review; Fairfax County Staff prepared an

<b>Table VII-1-1</b> <b>Possible Airport Noise Abatement Actions</b>	
<b><u>Airport Feature and Activity</u></b>	<b><u>Possible Noise Abatement Actions</u></b>
Flight Tracks	Direct aircraft away from populated areas
Preferential runways	Foster use of runways with least impact
Restrict noisy aircraft	Minimize operations during day or night
Noise abatement flight procedures	Require use of noise abatement throttle and flap management procedures for takeoff and/or approach
Airport layout	Extend or build new runways and taxiways to make best use of compatible land and water
Shielding barriers	Shield people from noise of ground operations
Building soundproofing	Soundproof schools, homes, and churches
Land use control	Ensure compatible land use through acquisition of property or other rights
Monitor and model	Monitor airport noise and flight tracks to provide data to the public and for evaluating proposed alternatives
Communications	Listen to complaints and suggestions; develop and institutionalize continuing effective dialogue and information transfer among all concerned parties

Source: Cavanaugh, William J. and Gregory C. Tocci, *Environmental Noise: The Invisible Pollutant*, E<sub>2</sub>SC, Volume 1, Number 1, USC Institute of Public Affairs, Fall, 1998.

assessment of the 2-Volume report with the assistance and input from a number of agencies in County government, EQAC, and others.

The proposed action is to redesign the airspace in the Baltimore-Washington metropolitan area excluding noise abatement procedures. This involves new routes, altitudes and procedures to take advantage of the newly consolidated TRACON, improved aircraft performance and emerging ATC technologies. Essentially, before the TRACON was established at the Vint Hill Farms in Fauquier County, Virginia, there were four independent TRACONs for each of the BWI, Dulles, Reagan National and Andrews Air Force Base, Maryland airspace. Later in the study, the Richmond area was added to the study area. Many other smaller airports within the study area were included as well. The concept of the consolidated TRACON is that one control center would do a better job of controlling aircraft in, around and out of the affected airspace, a 75-Nautical mile radius

centered on a radio navigational aid (NAVAID), Non-Directional Beacon (NDB) in Georgetown, within the District of Columbia. The study area comprises portions of five states – Delaware, Maryland, Pennsylvania, Virginia and West Virginia. The study tiers off the former EIS study that considered locating a single TRACON in the same area. That process resulted in the FAA issuing a Record of Decision (ROD) documenting that consolidation the four existing TRACONs into the new facility at Vint Hills. Subsequent to the ROD, it was decided to add the Richmond, Virginia TRACON into this current study.

A total of 19 impact categories are addressed in the current EIS using criteria defined in the FAA Order 1050.1D, Change 4 “Policies and Procedures For Considering Environmental Impacts.” The study team evaluated 4 Alternatives against the FAA criteria. For the purpose of the EIS, increases of 3 dB in areas that would be exposed to DNL between 60 and 65 dB were considered to have slight-to-moderate impacts. Increases of 5 dB or greater in areas that would be exposed to DNL between 45 dB and 60 dB are also considered to be slight-to-moderate impacts. The increase in noise at these levels is enough to be noticeable and potentially disturbing to some people, but the cumulative noise level and the magnitude of the change are not high enough to constitute a significant impact. The conclusions of the Draft EIS follow:

- ☐ The proposed alternatives do not result in significant noise impacts
- ☐ There would be no significant impacts as it relates to compatible land uses.
- ☐ The Alternatives would not impose a change that would disproportionately impact minority or low-income households for any of the impact categories considered.
- ☐ Will not adversely affect historic and cultural resources.
- ☐ Impacts to migratory birds in Fairfax County would be minimal and not significant.
- ☐ None of the alternatives would result in negative air quality impacts due to the fact that the proposed alternatives are intended to accommodate current and forecasted demand.

## **G. HIGHWAY NOISE**

### **1. Background**

Traffic in the Washington metropolitan area, including Fairfax County, continues to grow with intense residential development in Loudoun and Prince William Counties. The area ranks second nationally for the worst commuting times behind Los Angeles. As more lanes are added and some new roads are constructed, increased traffic generates more noise that creates demands for noise attenuation or abatement measures. These measures include separating the receiver from the source by distance, constructing barriers/walls or berms, providing landscaping/vegetation, or providing acoustical design techniques. Barriers have become the most popular choice. Since

1991 in Fairfax County, they consist of a solid wall of absorptive concrete that breaks the line of sight between vehicles and homes. Although noise barriers have a maximum decibel reduction of 20 dBA, most only provide 10-12 decibel reductions.

## **2. State Policy**

Virginia adopted its original noise abatement policy in 1989. The policy established criteria for providing noise protection in conjunction with proposed highway projects in the State. Implementation of the policy has aided in the construction, or construction approval, of more than 100 federally-funded sound barriers. Experience with this policy created considerable feedback from citizens and elected officials. As a result, the Commonwealth Transportation Board decided to evaluate the policy for possible changes. The major source of information used was a survey of 15 State DOTs in the eastern U.S. The culmination of this process was the adoption of changes to the State policy in November, 1996 which became effective in January, 1997.

The key changes to the policy were to: 1) raise the cost-effectiveness ceiling from \$20,000 per protected receptor to \$30,000 per protected residential property based other state practices; 2) clarify that Virginia will not participate in any retrofit project along an existing highway when not in conjunction with an improvement for that highway; and 3) add the possibility for third party funding of the amount above VDOT's \$30,000 ceiling if the abatement measure otherwise satisfies the criteria.

## **3. Noise Study Submission Guidelines**

On July 24, 2000, the Board of Supervisors adopted Zoning Ordinance Amendment ZO 00-330, which permits noise barriers, in excess of the Zoning Ordinance fence/wall height limitations, to reduce adverse impacts of highway noise on properties adjacent to major thoroughfares, or to reduce adverse noise impacts of commercial and industrial uses on adjacent properties. Such barriers may be approved by the Board of Supervisors in conjunction with the approval of a proffered rezoning for any zoning district, including P districts, or in conjunction with the approval of a special exception application, or by the Board of Zoning Appeals as a special permit use. Pursuant to Par. 1 of Sect. 8-919 or Par. 3F of Sect. 10-104 of the Zoning Ordinance, a noise impact study is required to demonstrate the need for the noise barrier and the proposed height and level of mitigation to be achieved by the noise barrier. In conjunction with the adoption of this Zoning Ordinance Amendment, the Planning Commission and Board of Supervisors requested staff to develop standardized noise study submission guidelines, which would be submitted to the Planning Commission for review and comment prior to implementation.

In response to this request, a noise study submission form and guidelines were developed. This form requires the applicant to provide information regarding the assumptions and data used in the noise study, the results of the analysis and a detailed description of the visual impacts of the noise barrier and its effectiveness in providing noise mitigation. Given that the cost of providing this information may be prohibitive

for a noise barrier request on an individual residential lot, a second form has been developed which requires less information for noise barrier requests on individual residential properties.

Staff from the Department of Planning and Zoning, Department of Transportation and the Virginia Department of Transportation participated in the review and development of these guidelines. In addition, acoustical engineers from several acoustical consulting firms that have submitted noise studies to the County in the past were invited to provide written comments on two occasions; representatives from one consulting firm met with staff to discuss their issues and concerns regarding the proposed noise study submission guidelines. In addition, the guidelines have been transmitted to the Northern Virginia Building Industry Association (NVBIA) and the National Association of Industrial and Office Properties (NAIOP), by letter dated December 5, 2001, for their review and comment; however, no comments were received from these organizations. All comments and concerns received during this coordination were taken into consideration, and the noise study submission guidelines revised accordingly.

On March 14, 2002, the Planning Commission Environment Committee reviewed and endorsed the Noise Study Submission Guidelines. On March 20, 2002, the Planning Commission endorsed the guidelines.

On April 29, 2002, the Board of Supervisors accepted the proposed guidelines without change.

#### **4. State Projects in Fairfax County**

VDOT's Northern Virginia Office constructed the following sound barriers in FY 01-02:

- Widening of Route 123 to 4-lanes at Lee Chapel Road to Davis Drive
- Widening of Route 1 from Lorton to Telegraph Road
- Springfield Interchange sound barriers, under various phases of construction

The following barriers have been approved and construction is anticipated to begin on them in FY 01-02:

- Capitol Beltway at West Langley Subdivision in Fairfax County
- All County-funded work on the Fairfax County Parkway noise barriers has been completed. All future work on noise barriers will be through the Virginia Department of Transportation.

## **H. RECOMMENDATIONS**

1. The Fairfax County Executive and his staff should continue to monitor the development of the EIS for the Airspace Redesign beyond the draft phase, monitor the docket resulting from public comments, revisions to the current version, etc. for developments and considerations raised by others that might, if fixed, impose impacts on our air space and environment.
2. The Fairfax County Executive and his staff should continue to monitor the MWAA quarterly reports and statistics to monitor trends associated with complaints, violations, and civil penalties. With the data base, the County Executive and his staff will be better positioned to intercede for residents should trends reflect a major shift or increase in noise levels and complaints.

## **VII-2. LIGHT POLLUTION**

### **A. OVERVIEW**

Light pollution is a general term used to describe light output primarily from exterior (outdoor) sources in commercial, residential, and roadway settings that is excessive in amount and/or that causes harmful glare to be directed into the path of travel or into residential neighborhoods. Light pollution is thus both a safety issue and a quality of life issue. With the increasing urbanization of Fairfax County, exterior (outdoor) lighting and light pollution in its many forms have become pressing issues to our communities. At present, Fairfax County has some regulations regarding exterior lighting, but they are minimal and out of date, since they do not take into account the numerous major advances that have been made in lighting technology in recent years.

The County staff has been working on a revision of the lighting ordinance for more than two years, and, shortly before this report went to press, released a proposed draft of a revision. In EQAC's opinion, this draft is significantly flawed in a number of respects and inadequate in the comprehensiveness with which it addresses a number of problem areas. Therefore, in EQAC's opinion, it will require substantial modification and expansion to make it an acceptable ordinance.

### **B. ISSUES AND PROBLEMS**

The main issues and problems of exterior lighting and light pollution may be summarized as follows:

#### **1. Glare**

Glare, as defined by the Illuminating Engineering Society of North America (IESNA), falls into three main categories:

- a. Disability glare – Disability glare, also known as veiling luminance, is caused by light sources that shine directly into one's eyes and is dangerous because it is blinding.
- b. Discomfort glare – Discomfort glare does not necessarily reduce the ability to see an object, but it produces a sensation of discomfort due to high contrast or non-uniform distribution of light in the field of view.
- c. Nuisance or annoyance glare – Nuisance glare is that which causes complaints such as, "The light is shining in my window."

Glare is a significant and pervasive problem that seriously impairs both safety and quality of life. Glare demands attention in that one's eyes are naturally attracted to bright light, and at night this destroys the eye's dark adaptation, which is a serious driving hazard. Obtrusive lighting by commercial establishments to attract attention is a serious problem as is selection of inappropriate fixtures for exterior residential lighting. Glare and excessive illumination cast into surrounding residential neighborhoods not only detracts from the quality of life but can make it difficult for pedestrians and homeowners to see their surroundings.

## **2. Light Trespass**

Light-trespass is the poor control of outdoor lighting such that it crosses property lines and detracts from the property value and quality of life of those whose property is so invaded. It is particularly common when obtrusive commercial lighting is immediately adjacent to residential neighborhoods or when a homeowner uses inappropriate fixtures, light levels, and lighting duration, often in the interest of "security." It is generally categorized in two forms:

- a. Adjacent property is illuminated by unwanted light.
- b. Excessive brightness occurs in the normal field of view.

Both of these forms may be present in a given situation.

## **3. Security**

Much outdoor lighting is used in the interest of providing security. These safety concerns often result in bad lighting rather than real security. One reason often cited for today's bright lights is that high wattage is needed to deter crime. If light is overly bright with excessive glare it makes it easier for a person to hide in the deep shadows created by objects in the harsh glaring light. This might actually encourage crime rather than discouraging it. The debate as to whether or not additional light provides more safety has been more emotional than factual. The few rigorous studies that have been done reveal no connection between higher lighting levels and lower crime rates. This may be due to people with nefarious intent taking more risks in better lit areas. For example, the National Institute of Law Enforcement and Criminal Justice found no statistically significant evidence that lighting impacts the level of crime (Upgren, 1996). Thus, the supposed correlation between a high level of security lighting and reduced crime appears to be nothing more than a popular myth.

## **4. Urban Sky Glow**

Urban sky glow is brightening of the night sky due to manmade lighting that passes upward with the light rays reflected off of submicroscopic dust and water particles in the atmosphere. Although urban sky glow was first noted as a problem by the astronomical community, it is by no means any longer an astronomical issue. With the

increasing urbanization of many areas of the U.S., all citizens in those areas are now being affected. In Fairfax County, which is now an urban county, improper lighting has seriously degraded the darkness of our local night skies into a pallid luminescence that many of our citizens find objectionable.

## **5. Energy Usage**

Smart lighting techniques, which direct all of the light generated onto the target area, reduce energy consumption and hence the use of fossil fuels. Several engineering estimates suggest that at least 30 percent of outdoor lighting is being wasted through spilling upward and outward rather than being directed downward onto the target area. Also, many installations are greatly over-illuminated as well as being lighted for unnecessary durations, further compounding the energy wastage. Inefficient lighting incurs both direct financial costs and hidden environmental costs. It has been estimated by national organizations studying light pollution that in excess of \$8 billion of electricity is being wasted annually on obtrusive and inefficient outdoor lighting (see data from Virginia Outdoor Lighting Task Force and the International Dark-Sky Association). Since electricity generation in the eastern part of this country is mostly from fossil fuels, every unnecessary kilowatt of electrical energy generated also produces unnecessary greenhouse gases and acid rain.

## **C. CURRENT COUNTY STANDARDS AND REGULATIONS**

In EQAC's view, Fairfax County currently has a minimal ordinance that does prescribe limits for the maximum wattage of light sources and for the amount of glare in residential districts. However, these standards do not cover all roadways (particularly main roadways, which are under the jurisdiction of the Virginia Department of Transportation (VDOT)) nor is there any policy regarding residential street lighting. Additionally, the combined effects of glare into residential neighborhoods from sources such as park lights and lights on nearby commercial buildings are not fully addressed.

Fairfax County's *Policy Plan: The Countywide Policy Element of the Comprehensive Plan* (2000 Edition) recognizes the nuisance of light emissions arising from increasing urbanization and recommends that efforts be made to avoid creating sources of glare that interfere with residents' and/or travelers' visual acuity. To put this into practice, the current County Zoning Ordinance lists glare standards. Specifically, it requires that illumination shall not produce glare in residential districts in excess of 0.5 foot candles and that flickering or bright sources of light shall avoid being a nuisance in residential districts. It also prescribes limits for the maximum intensity of light sources as follows:

SOURCE	INTENSITY	
	Group I	Group II
Bare incandescent bulbs	15 watts	40 watts
Illuminated buildings	15 foot candles	30 foot candles
Back lighted or luminous background signs	150 foot lamberts	250 foot lamberts

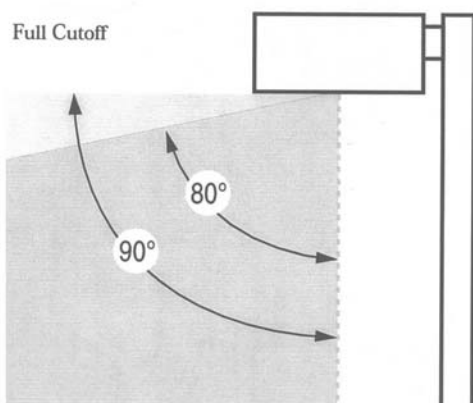
Group I applies to all residential zoning as well as commercial districts 1 through 4 and industrial districts 1 through 4. Group II is limited to commercial districts 5 through 8 and industrial districts 5 and 6.

## D. ADDRESSING THE PROBLEM

One of the most common street lights in use, the cobra-head fixture, draws 150 watts. A fixture with reflective backing and shielding can direct all light below the horizontal plane with the same illumination of streets and homes and use only 100 watts. The same possibility exists with the popular 175 watt unshielded mercury vapor lamp. Both the 150-watt cobra-head fixture and the 175-watt mercury vapor lamp cast light laterally as well as down. As a result, substantial glare is often cast directly into the eyes of drivers. This glare destroys drivers' dark adaptation, creating potential safety hazards. In many cases the driver is not able to see the roadway any better than he or she would with lower-wattage properly shielded lights, and in many cases his or her vision is much worse. Because they cut down on glare, shielded fixtures not only are safer for drivers, but according to experts (see references) actually make it easier for pedestrians and home owners to see their surroundings.

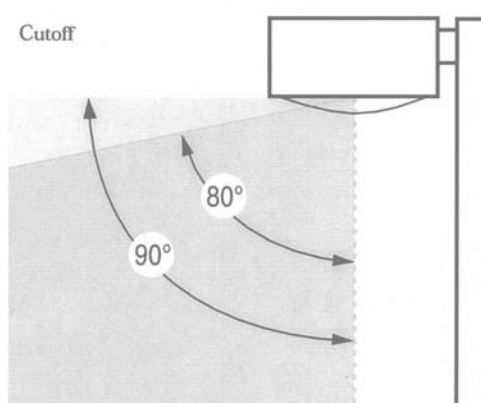
By redirecting this wasted energy, lower wattage lights provide the same amount of illumination in the areas where it is needed. These fixtures have reflective backing and full cut-off shielding to direct all light below the horizontal plane, with 90 percent of the light directed below an angle of 20 degrees from the horizontal. For example, a 50-watt metal halide lamp with a reflective shield will provide as much illumination below the horizontal plane as the 150-watt cobra-head fixture or the 175-watt unshielded mercury vapor lamp. These newer types of fixtures, which are recommended by the Illuminating Engineering Society of North America, are widely available and direct all light below the horizontal plane, thereby eliminating lateral glare (see Figure VII-2-1). It is estimated that it takes only three years of energy savings to recoup the initial investment in these fixtures. The lower wattage fixtures provide energy savings, improved driver safety, better visibility for pedestrians, and an improved ambiance and security for neighborhoods. Several municipalities, such as Tuscon, San Diego, and Sanibel Island, Florida, have adopted street lighting ordinances requiring these newer fixtures.

Figure VII-2-1  
Effects of Cut-off and Non Cut-off Luminaires



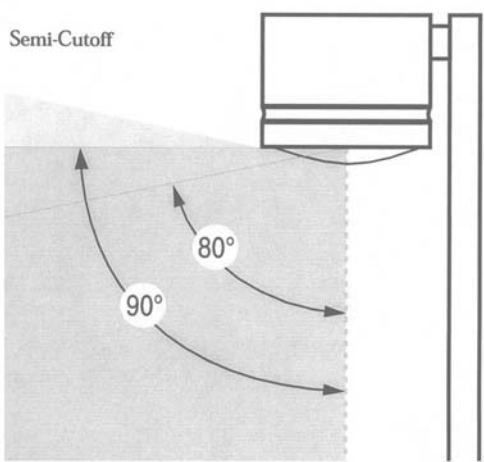
**ALLOWS:**

- No light at 90 degrees
- 100 cd per 1000 Lamp Lumens at 80 degrees



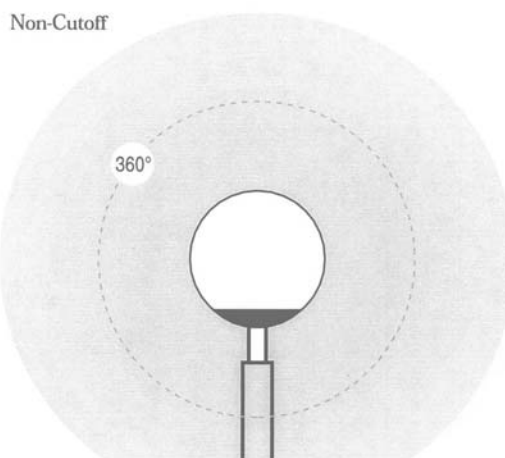
**ALLOWS:**

- 25 cd per 1000 Lamp Lumens at 90 degrees
- 100 cd per 1000 Lamp Lumens at 80 degrees



**ALLOWS:**

- 50 cd per 1000 Lamp Lumens at 90 degrees
- 200 cd per 1000 Lamp Lumens at 80 degrees



**ALLOWS:**

- Unrestricted distribution of light at any angle

(Sources: Paulin, Douglas, *Full Cutoff Lighting: The Benefits*, IESNA website, and Shaflik, Carl, *Environmental Effects of Roadway Lighting*, Information Sheet Number 125, International Dark-Sky Association, Tucson, Arizona, August 1997.)

Most security lighting is overdone, with high wattage lights burning from sundown to sunup. As noted earlier, constant levels of illumination tend to be largely ignored because they are commonplace, and they waste a huge amount of energy. The large amount of glare produced by high intensity sources creates shadows that provide hiding places for intruders. Moreover, the constant glare and light trespass onto adjacent properties is a major source of annoyance to their occupants. On the other hand, lights that are activated by motion within a controlled area attract immediate attention and, at the same time, use very little energy and create intrusion on adjacent properties only when such attention is desired. For example, if one is using 300 watts of security lighting for 10 hours each night and converts to an infrared motion sensor control that turns on the lights only when there is motion in the controlled area, energy cost is reduced to almost nil. In addition, the cost of the added sensor-control hardware itself can be recovered in as little as two months due to the energy saving. At the same time security is increased rather than decreased, and glare and light trespass onto adjacent properties is virtually eliminated.

Glare is a significant and pervasive problem, but one that is easily solved by installing fully shielded light fixtures. Where it is not possible to completely eliminate glare through the use of shielded fixtures, motion detector controls can limit the harsh light to only a minute or two when it is really needed.

Light-trespass is a term of relatively recent origin and denotes (1) glare that is generated by sources on one property that lie within the normal field of view of the occupants of another property, and (2) light that spills over the boundaries of one property onto another, thereby producing unwanted illumination of it. Increasingly, such light intrusions are being regarded as trespass violations every bit as serious as physical trespass of a person onto the property of another. Such problems can now be readily avoided by the selection of proper fixtures, intensity levels, and the use of timers and sensors/controllers. This is an area where a comprehensive and robust revised County ordinance is badly needed.

Sky-glow is also readily addressed by the selection of properly designed modern fixtures for new installations and phased retrofit of current inadequate installations. The cost of such retrofits is normally recoverable within a reasonable time period (usually estimated at about three years) through efficiently placing all of the light onto the desired area and the lower energy usage.

Adherence to the following four principles will do much to mitigate or eliminate light pollution.

- a. Always illuminate with properly shielded fixtures that prevent the light source itself, and the resultant glare, from being directly visible. This is done by using cutoff fixtures or supplementary shielding that keeps all of the illumination below the horizontal plane and directed onto the target area.
- b. Do not over-illuminate. Never use more illumination than needed for the task at hand. Using a 400 watt floodlight to illuminate a small parking area or a flag at

night is overkill and wastes a great deal of energy. A properly shielded and adjusted 250 watt luminaire (light source + fixture) can illuminate an area just as effectively as an older style 1,000 watt light source.

- c. Always aim lighting downward, keeping all of its distribution within the property lines and below the horizontal plane so that it is not a source of glare. Light trespass onto adjacent properties is unnecessary, inconsiderate, and potentially illegal.
- d. Do not burn lighting all night long with the intention of improving security. Using infrared motion sensor-controlled lighting that comes on instantly when there is motion in the designated area is far more effective as a security measure. That rapid change from dark to light draws the immediate attention of everyone in the surrounding area, including security and law enforcement personnel on patrol, and may well be unsettling enough to cause illicit intruders to immediately flee. Lighting that stays on all night draws no special attention and is an enormous waste of energy.

## **E. PUBLIC AGENCY RESPONSIBILITIES**

Compliance with glare standards for residences and other private property is the responsibility of the County's zoning enforcement staff. The County has 18 zoning inspectors (two per magisterial district) to oversee all Zoning Ordinance enforcement. Any enforcement activity dealing with light is complaint-driven. During 1997, the staff received 11 light-related complaints out of a total of 2,287 complaints. The County does not respond to anonymous complaints. Complaints are either filed directly with the Zoning Enforcement Branch or are forwarded by the staff of a member of the Board of Supervisors. The causes of the complaints were usually fast food establishments, security lighting for residences, athletic facilities (e.g., ball fields, driving ranges), or churches. The zoning inspectors typically resolve violations with informal enforcement such as a verbal warning that there is a violation and how it may be remedied. A written notice of violation or civil action can be used if needed. Beyond the general glare standards, the County frequently has been able to impose additional restrictions through the provisions of the rezoning, special permit and special exception processes. However, it is clear to EQAC that that a revised ordinance must set standards and regulation for all types of uses and development within the County, including single family residential and by-right development.

One of the most onerous sources of light pollution is the obtrusive lighting of commercial and industrial facilities, particularly commercial retail and service establishments. While their desire to attract attention to themselves is understandable, abusive excesses degrade the overall ambience of our commercial areas and materially degrade the quality of life in adjacent residential neighborhoods. In EQAC's view, this is exacerbated by the current absence of a comprehensive and carefully drawn ordinance, especially in the areas of glare and light-trespass onto the properties of others. It is of particular concern in the case of

“by-right” development where there are no public hearings (e.g., Planning Commission, Board of Zoning Appeals, Board of Supervisors) at which adjacent property owners and neighborhoods can register their concerns and see approval conditioned on appropriate restrictions. In such “by-right” cases, the initial responsibility would necessarily fall almost entirely upon the Office of Building Code Services of the Department of Public Works and Environmental Services, which reviews all proposed plans before a building permit is issued and subsequently conducts inspections to ensure that the work is in compliance with regulations. Evaluation of plans for compliance would add a small amount of effort to the review process but would add only a negligible amount to the inspection process.

At this time the County has no formal policies regarding street lighting. Some neighborhoods within the County prefer street lighting, while others do not. Whether or not the County provides street lighting is often driven by budget priorities, and, unless there is a demonstrable public safety need, the priority for retrofitting an established community is usually low. More often, street lighting is addressed in the overall planning of new subdivisions. In these cases, the Office of Site Development Services would have responsibilities for both reviewing the plan and inspecting the implementation of it.

Responsibility for the lighting of main roadways is under the jurisdiction of VDOT. Historically, local communities and neighborhoods have had to deal directly with VDOT over roadway lighting issues. It has proven very difficult to influence VDOT’s choice of fixtures and technical standards, even when it can be demonstrated that their proposed implementations will result in unacceptable levels of glare and light trespass in adjacent residential neighborhoods. However, in the past year significant headway has been made in getting VDOT to recognize the severity of the problem and to take some limited first steps to address it. Recently, Fairfax County won a case against VDOT in the Virginia Supreme Court over whether VDOT had to consider County zoning regulations in its placement of monopole communication towers in VDOT rights-of-way within the County. For some time VDOT has been developing plans for extensive lighting of the Virginia portion of the Capitol Beltway from the Wilson Bridge to the Cabin John Bridge without regard to the impact on dozens of adjacent neighborhoods and thousands of our citizens. Perhaps a similar determination should be sought as to whether the County can limit VDOT’s options for luminaries (lamp+fixture) to be used for roadway lighting on VDOT maintained roadways within the County and even whether such lighting is needed at all.

It should be noted that the Department of Planning and Zoning has been reviewing a number of the things discussed and recommended in this report for approximately the past two and one-half years, and during this period has been drafting revisions to the present very limited ordinance. However, shortly before this report went to press, the draft ordinance was released for preliminary review. It is EQAC’s opinion that the proposed revision is neither sufficiently comprehensive nor adequately robust and will require major enhancement and modification at the staff, Planning Commission, and Board of Supervisors levels in order to have credibility and gain acceptance.

## **F. PUBLIC EDUCATION AND AWARENESS NEEDS**

The general public needs to be made aware of the sources and problems of light pollution and of the methods by which these can be best addressed. This can be done in two ways. First, an informative brochure should be prepared that can be made available to individuals, homeowners groups, and community associations. Brochures could be made available through appropriate County offices and through the district offices of the members of the Board of Supervisors. Even more effective would be to make the information available through the County's web site, which has become an exemplary vehicle for distributing the latest information relating to all aspects of County governance and services.

A few jurisdictions in other areas have prepared technical brochures and bulletins to familiarize architects, contractors, and electricians with their lighting codes and to specifically describe what their jurisdictions do not permit (e.g., unshielded security lights, angle-directed post or building mounted fixtures, wall packs without shielding or baffling, excessive wattage or unshielded floodlights, light-trespass onto other properties, etc.) and what they recommend. Fairfax County should prepare a brochure of this type to coincide with the introduction of a new ordinance so that the development, contractor, and building management communities will be fully aware from the outset of the revised standards and how best to address them.

There is an excellent website (<http://www.qualityoutdoorlighting.com>) that illustrates many examples of good, bad, and ill-conceived lighting practices right here in our local area. It can play a central role in education of the public.

## **G. CONCLUSIONS**

The principal means to prevent poor exterior lighting practices is a comprehensive code or ordinance, because this provides an enforceable legal restriction on specific lighting practices that are deemed unacceptable to the community and its quality of life. Numerous jurisdictions have adopted codes and ordinances that have proven very effective in reducing light pollution and preventing light trespass. A properly conceived and well written code will permit all forms of necessary illumination at reasonable intensities, but will require shielding and other measures to prevent light pollution and light trespass. A good code will apply to all forms of outdoor lighting, including streets, highways, and exterior signs, as well as lighting on dwellings, commercial and industrial buildings, parking areas, and construction sites. A good code will also provide for reasonable exceptions for special uses within acceptable time periods and subject to effective standards. In EQAC's opinion, the current County code is outdated and inadequate, and the initial draft of a revision is also inadequate and significantly flawed.

The County needs to work closely with VDOT to achieve better lighting practices on roadways within Fairfax County that are under VDOT jurisdiction. Current VDOT

lighting and proposed new installations are regarded as being very intrusive by adjacent neighborhoods. However, it should be noted that a newly enacted law requiring the Commonwealth to acquire only shielded fixtures should materially improve VDOT practices in this regard. In addition, consideration should be given to seeking a legal determination as to whether VDOT can be constrained by County ordinances.

Much of the security lighting, both residential and commercial, in Fairfax County is poorly conceived, excessive in intensity, and improperly directed and controlled. These deficiencies could be corrected at relatively low initial costs that would be rapidly recovered through the energy savings realized.

Much lighting in residential neighborhoods uses old style fixtures that cause light trespass onto adjacent properties. A new comprehensive code and public awareness campaign must address correction of these problems. Under no circumstances should single family dwellings be exempted from any of the provisions of a revised code, for that is where the majority of us live and where our quality of life is most affected by intrusive lighting.

Poor lighting design, particularly in commercial areas, is contributing to excessive and highly objectionable sky-glow. A new code and retrofitting or adjustment of fixtures could eliminate the worst of this effect.

## **H. RECOMMENDATIONS**

1. EQAC recommends that the Board of Supervisors direct the Department of Planning and Zoning to immediately correct the deficiencies in the draft revised ordinance to properly and adequately address lighting standards and practices in Fairfax County and the problems of light pollution and to use the input of suitably qualified outside assistance to achieve this.
2. EQAC recommends that the Board of Supervisors direct that all future exterior lighting fixtures installed on Fairfax County facilities and properties follow the recommendation of the Illuminating Engineering Society of North America that most lighting fixtures be fully shielded and direct all light below the horizontal plane.
3. EQAC recommends that the Board of Supervisors direct that all older lighting fixtures under County control that do not meet the above standard be replaced on a phased basis with these newer recommended fixtures. EQAC notes that these steps will lead to significantly lower energy costs that will recoup the costs of the changeover in a reasonable period of time.
4. EQAC recommends that the Board of Supervisors work with VDOT and Virginia elected officials to achieve replacement of existing poorly designed fixtures on our roadways (under the control of VDOT) with the same type of fixtures recommended in Recommendation 3 above.

5. EQAC recommends that the Board of Supervisors direct the County Attorney to evaluate the feasibility of seeking a legal determination at the Virginia Supreme Court level (using the monopoly decision as precedent) of whether VDOT can be required to consider a County outdoor lighting ordinance in planning and implementing roadway lighting within the County.
6. EQAC recommends that the Board of Supervisors direct the County staff to prepare both a printed brochure and an item on the County web site to promote public awareness of issues, problems, and solutions connected with illumination and light pollution. EQAC further recommends that the Board of Supervisors direct that a technical brochure be prepared for the education of architects, contractors, electricians, and builders as to what the County permits and does not permit in the field of illumination. Both of the above items should be made available at the time a comprehensive illumination ordinance is adopted by the Board.

## LIST OF REFERENCES

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Fairfax County, Virginia, *Policy Plan: The Countywide Policy Element of the Comprehensive Plan*, 2000 Edition.

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Illuminating Engineering Society of North America web site, <http://www.iesna.org/>.  
(There are numerous subsidiary and related web sites

International Dark-Sky Association web site, <http://www.darksky.org/>

National Electrical Manufacturers Association website, <http://www.nema.org/>.  
(Particularly see their White Paper on Outdoor Lighting Code Issues.)

Virginia Outdoor Lighting Taskforce (VOLT) web site, <http://www.volt.org/> .

Quality Outdoor Lighting website, <http://www.qualityoutdoorlighting.com/> .

## VII-3. URBAN POLLUTION: VISUAL BLIGHT

**"Pollution is the contamination of the environment as a result of human activities."**

### A. OVERVIEW

The term pollution refers primarily to the fouling of air, water, and land by wastes. In recent years it has come to signify a wider range of disruptions to environmental quality. Thus litter, billboards, and auto junkyards are said to constitute visual pollution. Light and noise are also pollutants in urban and suburban areas -- Over the last one hundred years, the increase of artificial light reflected from city streets and buildings has eroded our ability to see the night sky. Scientists say nearly two-thirds of the United States population can no longer see the Milky Way<sup>2</sup>. With respect to noise, noise excessive enough to cause psychological or physical damage is considered noise pollution. Both noise pollution and light pollution issues have been addressed earlier in this chapter. This section of the chapter focuses, therefore, on visual blight/pollution issues.

During the 1960s, 1970s and early 1980s, visual blight problems were generally attributed to air pollution and its effects on the ability to view and appreciate the beauty of scenic vistas and national parks. Smog, brown-cloud, haze and other atmospheric aberrations caused a public outcry followed by activity by the Federal Government. Webster's defines "blight" as -- 1: a disease or injury of plants resulting in withering, cessation of growth, and death of parts without rotting by an organism that causes blight; 2: something that frustrates plans or hopes; 3: something that impairs or destroys; 4: a deteriorated condition (urban blight). Certainly, definitions 2 through 4 characterize the emotions that the general public must have felt when after long trips, the beauty of the national park vistas and parks was impeded because of atmospheric conditions.

In more recent times, urban visual blight has morphed to include a wide range of reality of many communities. Fairfax County is not precluded from many of modern-day urban visual blight. In this report, we are equating "blight" and "pollution" as having generally the same definition. Pollution frustrates plans or hopes, it does impair or destroy life forms, and it is certainly representative of a deteriorated condition. Thus, brownfields, billboards, lighting that impairs our ability to enjoy astronomical observations, exhaust fumes from mobile sources, trash and litter on roadsides, unkempt properties, above-ground power and video transmission lines, political advertising, other forms of extraneous and non-professional advertising, are classified today as urban blight, or visual pollution. As noted earlier, lighting issues have been dealt with elsewhere in this chapter and are therefore not addressed within this section of the report. Air quality issues, as they relate to local compliance with Federal standards, are also addressed elsewhere in this report. With respect to brownfields, billboards, and transmission lines, EQAC will be studying these

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<sup>2</sup> **Tim Bauer**, Park Supervisor, Lake Hudson Recreation Area in Michigan

issues further to determine their applicability to Fairfax County; however, these topics will not be addressed further in this year's *Annual Report*.

## B. SIGNAGE

Fairfax County developed and promulgated an ordinance to deal with signage, **Fairfax County Zoning Ordinance (Chapter 112 of the Fairfax County Code), Article 12, Signs**. It basically deals with permitted and non-permitted signage (e.g., what kind of sign needs a permit versus that signage not requiring a permit). For example, the Ordinance states when political or other signage that is temporary in nature must be removed, etc. The Ordinance appears to cover the subject thoroughly, but that facts would suggest that enforcement is lacking, or the bureaucracy is not organized in a way that would ensure cost effective enforcement.

On September 10, 2001, the Fairfax County Sign Task Force issued their report titled, *"Illegal Signs in the Right of Way."* The Board of Supervisors initiated formation of the Task Force in August of 2000 to:

- Examine current practices and enforcement procedures regarding signs within and along the roadways;
- Investigate other jurisdictions' best practices in dealing with illegal signs (pursuant to Article 12);
- Recommend or suggest legislative or amendments to the County's sign ordinance.

Illegal signs in the public rights-of-way have been around for as long as there have been public rights-of-way, but the numbers have spiraled out of control in recent years. Between fields of "popsicle-stick" signs for homebuilders and politicians, and signs for weight loss, work-at-home businesses, hauling, and other signs plastered on every available traffic sign and utility pole, everyone in Fairfax County has something to hate about illegal signs.

As noted above, the Task Force concluded that there is no one agency within the County government that is devoted to removing those signs or prosecuting persons who erect the signs in violation of the law. The Task Force concluded that cleanup efforts are inadequate unless a County official receives complaints or unless the VDOT receives complaints. Therefore, it appears that what little effort there is to remove signs is responsive rather than proactive. Some neighboring communities assign specific persons to this job, but Fairfax County does not have such a system. In fact, Zoning Inspectors do have authority delegated to them from VDOT to remove illegal signs. However, on many occasions when County inspectors have removed signs; e.g, on a Friday evening, they are back up by Monday morning or sooner. Good citizens attempting to help the County by removing signs themselves are not authorized to do so; therefore, they are inviting a liability when they do remove signs.

The Task Force made several recommendations. We urge the Board of Supervisors to consider their report and either implement their findings or reconstitute the Task Force to find alternatives that are more palatable to the Board and citizens of the County.

- After holding a public hearing, the Board, pursuant to Virginia Code §33.1-375, should enter into an Agreement with the Commissioner of VDOT to enforce Virginia Code § 33.1-373. The Agreement would provide for sharing civil penalties collected after the County's costs have been recovered. [The Task Force provided a draft Agreement for the Board to consider.]
- The County should support the County Sheriff's program of using inmates for removal of roadside litter including removal of signs illegally posted in a right-of-way.
- Implement a pilot project of approximately 6 months to determine whether additional resources are needed, and if so, develop a list of alternatives for further evaluation and ranking in terms of cost benefit analysis for the Board to use as they decide whether to expand the Agreement or move into a different direction.
- Conduct a publicity, public outreach program, with the assistance of consulting experts in this field regarding restrictions of signs in the public rights-of-way and any new County program to prosecute sign violations.
- The County Executive should send letters to public entities within the County advising them of illegal signs and outcomes of posting same.
- The Board should invite VDOT to consider implementing in Fairfax County possible deterrents to minimize illegal signs in the rights-of-way.

The Task Force also proposed legislative changes such as:

- Seek an amendment to the Code of Virginia that would declare all signs illegally posted in a right-of-way to be abandoned or trashed may be removed by anyone.
- If not successful or possible, then the alternative is to seek an Amendment of the Code of Virginia that would permit individuals that participate in the Adopt-A-Highway program to remove or cleanup illegal signs as duly authorized representatives of the Commissioner.
- Seek an Amendment to the Code to address whether political campaign signs are subject to the restrictions on advertisements in the right-of-way. If so, then the County should consider offering recommendations that might limit the number, minimum distance between individual signs and time frame for posting and then removing the signs.
- Seek an Amendment to the Code to increase civil penalties the \$100 Civil Penalty.

## **C. RECOMMENDATION**

The recommendation provided below addresses only the third section of this chapter (Urban Pollution: Visual Blight). Recommendations addressing noise and light pollution are found beginning on pages VII-9 and VII-20, respectively.

1. The Environmental Quality Advisory Council supports the recommendations made by the Fairfax County Sign Task Force and recommends that the Board of Supervisors implement these recommendations.